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Abstract

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RAINFORESTS OF THE ILLAWARRA - J. Bywater

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INTRODUCTION

Subtropical rainforest is the most restricted and complex forest ecosystem in the Illawarra. These forest communities support a specialised endemic or native flora which contains many plant species at the southern limit of their range. Although no longer of commercial value as a timber source the local rainforests are of immense recreational, educational, and scientific value in a district where most of the natural forest has been replaced by agricultural, urban and industrial development.

RAINFOREST IN AUSTRALIA

Rainforests are closed forest communities which support a diverse array of humidity dependent flora. In Australia three types of rainforest occur and can be distinguished from each other by their floristic origin, community structure, predominant leaf size, and type and abundance of such accompanying lifeforms as vines, epiphytes, ferns and stranglers. Each rainforest type corresponds with a major climatic zone (Fig. 1). Tropical rainforest is found from about Ingham (Queensland) north to near the tip of Cape York Peninsula; subtropical rainforest extends south from Mackay (Queensland) to Mount Dromedary in southern New South Wales; and temperate rainforest has its most extensive distribution in Tasmania's mountain regions but also occurs in parts of the coastal ranges of both Victoria and New South Wales. At high elevations over its range tropical rainforests are replaced by subtropical rainforest and the latter, in turn, is replaced by temperate rainforest. The australian rainforests do not exhibit a continuous distribution but rather occur as a series of disjunctive or scattered forest communities amidst a variety of sclerophyll (leathery leaved) forest types. Each rainforest type has a rich luxuriant appearance and provides a dramatic vegetational contrast on a continent where the majority of life forms are associated with drier sclerophyll communities dominated by eucalyptus and acacias.

Rainforest, as the name suggests, requires a high annual rainfall. In the Illawarra its distribution is associated with annual rainfalls of greater than 1300mm (Bywater, 1978). Rainfall alone, however, is not the sole determining factor for, although sufficient rainfall for rainforest growth occurs over much of the district, rainforest is limited to certain restricted environments. Optimum rainforest development occurs in locations with good topographic shelter from the west, and usually in sites with a southeasterly aspect. Under these conditions moisture loss through dessication by dry westerly winds is minimised, as is their mechanically destructive effect upon the rainforests' closed canopies.

Today rainforest in the Illawarra occurs in three major locations each of which supports a distinct but related rainforest association (Fig. 2). A simple association occurs along some of the incised valleys on the plateau immediately to the west of the escarpment, a mixed rainforest association dominates shady and sheltered aspects of the escarpment benches and upper gullies, and a complex rainforest association is found on certain less exposed sections of the escarpment foothills of Jamberoo Valley.

ILLAWARRA RAINFOREST ASSOCIATIONS

Simple Associations

These forests occur as ribbon-like bands in sheltered gullies to the west of the escarpment (Fig. 3). They are restricted to sandy soils along the bottom of gullies and support only a few of the hardiest rainforest tree species. Coachwood is typically the dominant tree in this association, but sassafras, lillypilly, laurel, and cabbage-tree palm are also common. Ferns occur but only a few species are represented, while vines and epiphytes are scarce. Only one tree layer is present and no rainforest tree species develop above the canopy in the form of emergents.

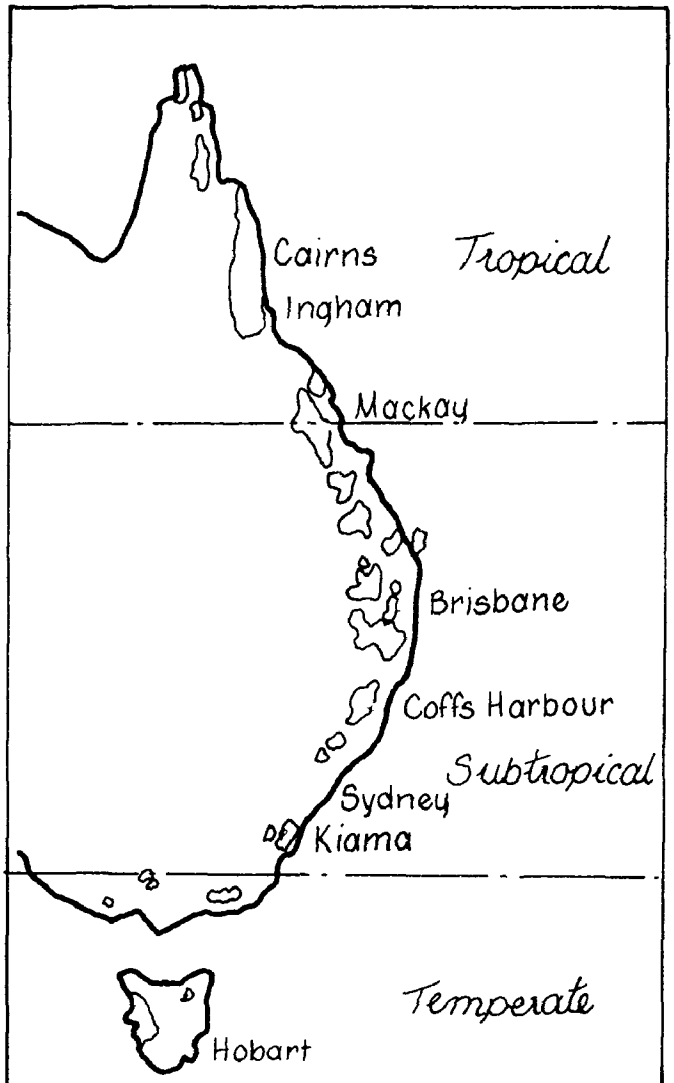
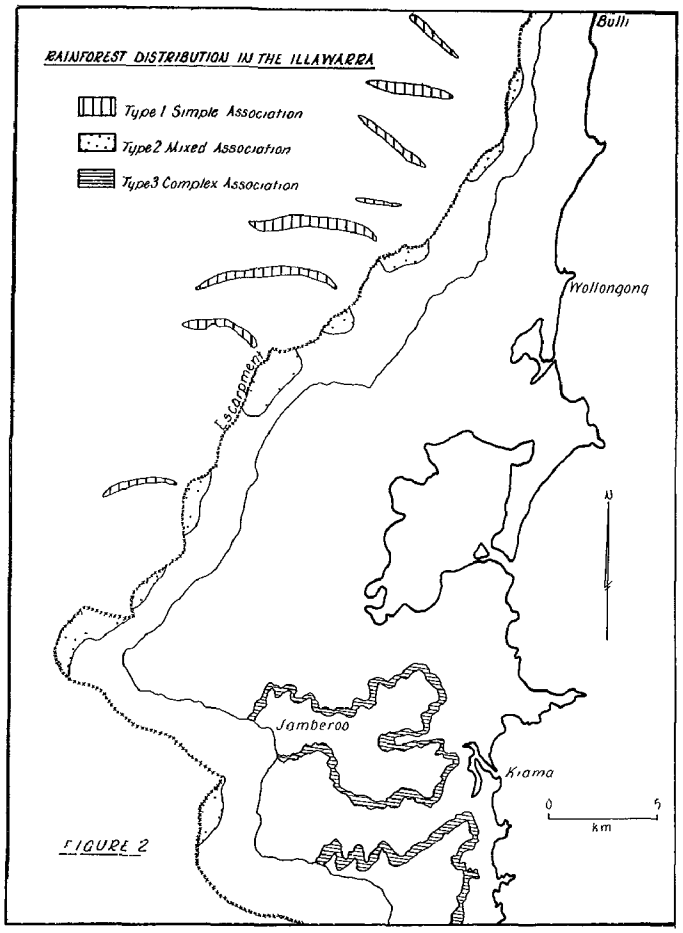


FIGURE 1: BROAD DISTRIBUTIONS OF RAINFOREST TYPES IN AUSTRALIA. (from Ecos 6 1975)



Mixed Rainforest

Mixed rainforest communities occur in well sheltered situations along the escarpment benches amongst the mainly wet sclerophyll forest of this area. These associations are characterised by a considerable diversity of tree species amongst which the species common in simple associations, as well as maidens bush, brown beech, and sandpaper fig (Fig. 3), show a tendency to dominate patches within a stand. Other relatively common species include red ash, red and white cedars, white beech, bolly gum, beef-wood, churnwood, myrtle, brush cherry, giant stinging tree, ebony myrtle, feather-wood, black apple, black plum, and crab apple.

Ferns are prolific and diverse and include four species of tree-fern; Cooper's tree-fern, prickley-tree fern, rough-tree fern, and soft-tree fern. Woody vines are common, as are epiphytes, especially staghorn fern and birdnest fern. This association shows the development of three layers with occasional emergent species towering above the upper canopy.

Complex Associations

Rainforests of this type are restricted to outcrops of volcanic latite in the Jamberoo Valley, and represent the remnants of a much larger rainforest present at the time of European settlement. Clearing for farming has restricted this association to steep headwall gullies and talus slopes. These forests exhibit an extremely diverse range of tree species and show no evidence of forest dominance by the common species of the escarpment associations.

Epiphytes and vines are common, with many species of the latter tightly interwoven throughout the canopy. Fern development is poor with fewer species than occur in the escarpment rainforests, and tree-ferns are absent. The paucity of ferns appears related to the absence of soil on the coarse bouldery latite this forest is now confined to, and may not be representative of the pre-settlement forest.

Development of two or three tree layers is evident in larger stands of this forest but this feature is often obscured in the more disturbed smaller patches. Emergents above the canopy, often fig species, are common and their presence often dominates the smaller stands of this association. The association shares a similar tree flora to the mixed rainforest association of the escarpment.

RAINFOREST ASSOCIATION VARIATION

The three rainforest associations of the Illawarra have many environmental conditions in common. They are all forests of sheltered moist situations in which high internal humidities and low light intensities are characteristic and all are generally restricted to less fire-prone sites. The major differences in rainforest appearance and flora that occur appear to be related to variations in soil nutrient status and possibly to the length of time free of fire.

TABLE 1

Available Nutrient *in parts per million*	SOIL NUTRIENT Type 1 *Simple* Association	Type 2 *Mixed* Association	Type 3 *Complex* Association
Calcium	125	575	920
Sodium	25	70	71
Phosphorus	15	20	90
Potassium	25	60	122
Magnesium	35	180	400
Nitrogen	12	28	182

Table 1 shows the levels of some plant nutrients extracted from soils of each rainforest association. It is evident that nutrient levels are lowest in soils from the simple associations and greatest in samples taken from the complex. This difference is soil nutrient status is the most likely reason for the major association differences. However, the role of fire also merits consideration for it considerably delimits rainforest distribution today. Apart from the knowledge that fires have frequently occured in the district and occasionally do burn out rainforest stands (Mount Kembla, 1968), it is not certain whether irregular burning of rainforest stands affects species diversity and stand structure to the extent that different associations develop. It may well be that simple associations are rainforest stands which have been burnt out too frequently to allow a more diverse and complex association to develop. The occurrence of simple associations in the most fire-prone region of the Illawarra adds weight to this theory which is currently under investigation (Bywater, 1979 in prep.).

RAINFOREST CHARACTERISTICS

Subtropical rainforest is the most complex (species rich) forest type in the Illawarra. A broad definition of this forest is a "Dense community of moisture loving trees, mainly evergreen, broadleaved species, usually with the trees arranged in several layers, and containing vines, epiphytes, buttressed stems, stranglers, and other lifeforms" (Baur, 1973, p.l.).

It can be distinguished from other forest types in the Illawarra by its characteristic closed canopy, open yet shady interior, and the abundance of specialised life forms which only occur in rainforest (stranglers, woody vines and many epiphytes). Mature rainforest does not normally contain any eucalyptus species or turpentine. The presence of these trees normally indicates wet sclerophyll forest regenerating after a catastrophe (usually fire).

The Illawarra supports the remnants of one of the five major areas of New South Wales rainforest growing at the time of European settlement and forms the southern distribution limit of many species of rainforest endemic flora (Baur, 1957).

Trees are dominant life forms of rainforest communities and over 80 tree species have been recorded from the Illawarra. The vast majority of rainforest trees are broadleafed evergreen species characterised by a tall, straight-stemmed shape with few lower branches. Tree crowns are narrow and interlaced with neighbouring tree crowns, giving the forest a typical layered appearance and what is termed a "closed canopy". The bark is generally thin and often covered with lichens, giving a pale patchy appearance and making the trunks of many different trees look very similar. A few rainforest trees have stem buttresses, which are an above ground development of the root system. The role of buttresses is uncertain but is like to be related to structural support. Trees possessing this feature include the larger figs (Moreton Bay fig, Port Jackson fig, and diciduous fig). As distinct from true stem buttressing,

strong fluting of the trunk is shown by chern-wood, black apple, and occasionally, giant stinging trees.

Stranglers are an interesting lifeform restricted to rainforest communities. Stranglers, of which figs are a typical example, are trees that are capable of both germinating from a seed on the forest floor, or growing epiphytically from a seed deposited on the branches of a host tree. In the latter situation the seed initially sends down aerial roots to the ground. As the strangler grows these roots form a dense network covering much of the host tree. Over time the host is gradually encased by the strangler and often dies.

A deciduous element occurs amongst rainforest trees and species of this nature include both the red and white cedars and the Illawarra flame tree. The latter is not a true deciduous species, however, for its shedding of leaves does not follow a seasonal cycle. During autumn and early winter the orange leaves of the deciduous species contrast strongly with the dark green of the rainforest canopy.

Many unusual tree species occur in the local rainforests. These include such distinctive trees as the giant stinging tree which has large soft leave covered with minute silicon hairs. The leaves of this tree can give a painfull long-lasting sting if touched. The sandpaper fig is interesting in that its leave have the texture of coarse sandpaper and, as well, this tree is the only local rainforest species to exhibit *cauliflory,* a condition in which buds and fruits are born directly upon the stem.

The birdlime tree has very sticky seedpots which are carried upon the fur of animal vectors. This mode of dispersal results in this tree being most common near animal tracks and shelters. Also adding to the "tropical" appearance of rainforest are the palms which are represented by two species. The bangalow palm is restricted to the rainforest, but the cabbage-tree palm also occurs in other forest types and should not, therefore, be regarded as unique to rainforest.

Most rainforest trees possess leave that are *mesomorphic,* that is, they are soft with little fibrous tissue, and are therefore not adapted to withstand dry conditions. Leaf shape and arrangement varies considerably but a common feature is the development of drip tips in many tree species. Drip tips are long drawn out leaf tips whose purpose appears related to theneed for rapid shedding of excessive moisture from the leaf surface.

Vines, or lianes as they are sometimes called, give a characteristic "jungle" appearance to rainforest. They usually occur as large wood "rope-like" strands hanging from the tree community. Foliage on vines is often not evident as it tends to occur high in the rainforest canopy. Vine growth is most prolific near light breaks and along water course margins. Typical vines in the Illawarra rainforests are water vine, and kangaroo vine.

Terrestrial ferns in the rainforest environment may be compared structurally with the grasses and herb cover of other forest types. Where the rainforest floor is suitable fern growth is prolific and under high moisture and nutrient rich coniditions a great diversity of fern species occurs. As well as dominating the forest floor, ferns also develop epiphytically upon the branches and trunks of many tree species. Tree-ferns, the largest of Australia's fern species are common in the simple and mixed rainforest associations but are absent from the complex forests.

Among the more interesting and unique flora of the rainforest environment are the "filmy ferns". This group is characterised by having delicate fronds only one cell in thickness. The thin frond allows them to absorb moisture from the atmosphere about the leaf surface. Members of this group are usually restricted to the wetter areas about creeks and waterfalls for their structure makes them very prone to dessication during drier periods.

Epiphytes are plants which grow upon, but do not parasitise other living plants. Although not restricted to rainforest, epiphytic plants show their greatest abundance in this environment. Typically, epiphytes occur upon the trunks and branches of many rainforest trees. Common epiphytes in the Illawarra rainforests are staghorn and birdnest ferns and rock orchid, all of which have become popular garden ornamentals.

MAN AND THE RAINFOREST

The impact of man upon rainforest distribution has been great. Although little is known of the effects of aboriginal man upon this type of forest it can be assument that his use of fire as a hunting tool had some influence upon the prevailing bushfire regimes and hence upon rainforest distribtuion. However, aboriginal man did not make deliberate efforts to clear rainforest. By contrast, European man has had a dramatic effect upon rainforest distribution. Initially rainforest stands were logged for their softwood timber, principally red cedar. On topographically suitable sites this was followed by clearing for agricultural purposes. As a result, by the late 19th Century rainforest had almost disappeared from the coastal plain and had been extensively logged along the escarpment.

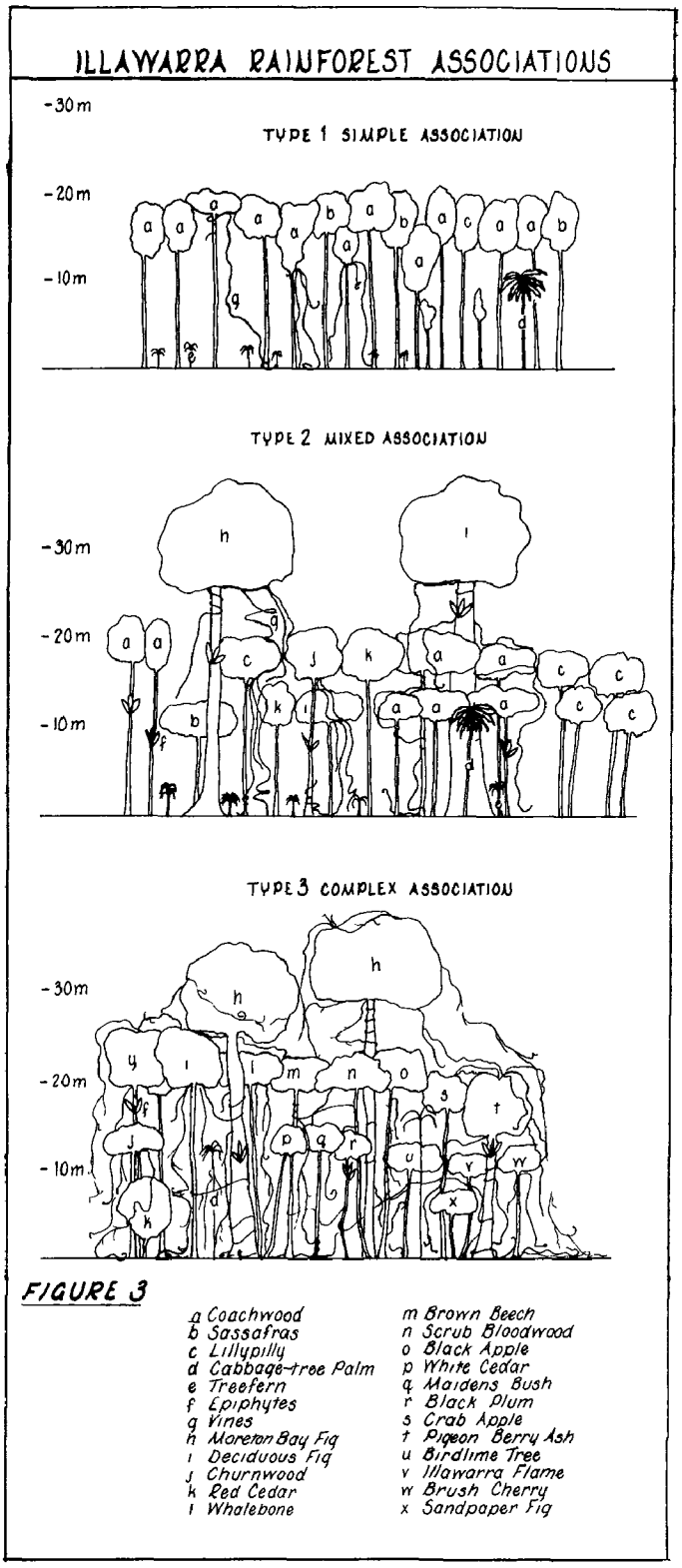


FIGURE 3

a Coachwood
b Sassafras
c Lillypilly
d Cabbage-tree Palm
e Treefern
f Epiphytes
g Vines
h Moreton Bay Fig
i Deciduous Fig
j Churnwood
k Red Cedar
l Whalebone
m Brown Beech
n Scrub Bloodwood
o Black Apple
p White Cedar
q Maidens Bush
r Black Plum
s Crab Apple
t Pigeon Berry Ash
u Birdlime Tree
v Illawarra Flame
w Brush Cherry
x Sandpoper Fig

Today, remaining rainforest associations are in little danger of further clearing for most occur in sites unsuitable for agriculture. Nevertheless, they are still subject to alteration by man, mainly by indiscriminate burning of bushland as a bushfire prevention policy, but also by road construction, which opens closed rainforest environments thereby exposing them to dessication causing dieback of rainforest flora and weed invasion.

Many accounts of the vegetation of the Illawarra refer to rainforest as having covered the escarpment and virtually all of the coastal plain at the time of European settlement. This commonly held but erroneous belief appears to have arisen from the misinterpretation of early popular accounts of the original vegetation and from vegetation reconstructions based upon the present day distribution of certain tree species thought to be restricted to rainforest. Although the early writings describing the original vegetation refer consistently to widespread dense "scrubs", "brush", and "jungles", these terms were applied quite freely to dense forests, regardless of their botanical nature, and consequently without any distinction between the distribution of wet sclerophyll and rainforest. Also, the use of the present day distribution of such trees as the cabbage-tree palm as an indication of former rainforest distribution fails to allow for the fact that this palm, although common in rainforest, also occurs naturally in many other forest (and non-forest) situations.

Nevertheless, it is clear that considerable areas of rainforest did occur in the Illawarra. Accounts of the extent of cedar-bearing rainforest are given by surveyor Meehan (1816) and Jervis (1938). Both delineate rainforest from other forest types and refer to the major and minor stand of the district. These writings, along with a knowledge of the environmental requirements necessary for rainforest development, allow a more realistic reconstruction of the former extent of rainforest to be given.

Then as now, simple rainforest was probably restricted to the margins of sheltered waterways to the west of the escarpment. Whether any of these communities were flooded with the building of the storage dams which are now in the region is uncertain. Mixed rainforest appears to have had a somewhat wider distribution. This association extended further down escarpment gullies to the coastal plain and lined creek banks on the plain itself. Complex rainforest apparently covered much of the volcanic soil in the Jamberoo-Kiama area and also occured on the volcanic soils just to the north of Lake Illawarra. The rest of the dense forests of the district were wet sclerophyll dominated by eucalyptus species though these probably contained many rainforest species in their understorey. The boundaries between wet sclerophyll forest and rainforest were probably not abrupt.

Although much reduced in extent, rainforest remains an important vegetation ecosystem in the Illawarra district. The rainforest associations described appear to be viable self perpetuating communities at present should remain so if disturbance by man is kept to a minimum.

Easily accessible areas where rainforest can be viewed include Mount Keira Scout Camp and Minnamurra Falls Reserve.

Diagrams drawn by Mrs. T. Woodward.
Enquiries about the series to be directed to Dr. R. Young, Department of Geography, University of Wollongong.

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PLANTS MENTIONED IN TEXT

Common Name	Scientific Name	Common Name	Scientific Name
Turpentine	Syncarpia glomulifera	Ebony Myrtle	Disopyres pentamara
Coachwood	Ceratopetalum apetalum	Feather-Wood	Polyosma cunninghamii
Sassafras	Doryphora sassafras	Balck Apple	Planchonella australis
Lilli pilly	Eugenia smithii	Black Plum	Diospyros australis
Laurel	Cryptocarya glaucescens	Crab Apple	*Schizomeria ovata*
Cabbage-tree palm	Livistonia australia	Moreton Bay Fig	Ficus macrophylla
Maiden's Bush	Sloanea australis	Port Jackson Fig	Ficus rubiginosa
Brown Beech	Pennantia cunninghamii	Deciduous Fig	Ficus henniana
Sandpaper Fig	Ficus coronata	Illawarra Flame Tree	Brachychiton acerifolium
Red Cedar	Toona australis	Birdlime Tree	Pisonia brunoniana
White Cedar	Melia azedarach	Prickly Tree-Fern	Cyathea leichhardtiana
White Beech	Gmelina leichhardtii	Rough Tree-Fern	Cyathea australis
Bolly Bum	Litsea reticulata	Cooper's Tree-Fern	Cyathea cooperi
Beef Wood	Stenocarpus salignus	Soft Tree-Fern	Dicksonia antarctious
Churn-Wood	Citronella mooroi	Staghorn Fern	Platycerium bifurcatum
Myrtle	Backhousia myrtfolia	Birdsnest Fern	Asplenium nidus
Brush Cherry	Syzygium paniculatum	Water Vine	Cissus hypoglauca
Giant Stinging Tree	Dendrocnide excelsa	Kangaroo Vine	Cissus antarctica

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